



GLOBAL AGENDA FOR
SUSTAINABLE LIVESTOCK

GOOD PRACTICE GUIDELINE

**Action Network 1: Closing the Efficiency Gap: Tools for
Decision-Making on Natural Resource Use Efficiency**

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The Global Agenda for Sustainable Livestock aims to build consensus between diverse stakeholders to increase sustainability of the livestock sector so as to deliver the Sustainable Development Goals (SDGs). It catalyzes practice change through dialogue, consultation and analysis of livestock production systems. Its Action Network 1 'Closing the efficiency gap' (previously named Focus Area 1) aims to enable improved efficiency of livestock production while also respecting wider aspects of sustainability. Its first phase has focused on developing tools and metrics to quantify natural resource use efficiency (NRUE), exploring efficiency gaps and identifying current initiatives which can implement these tools. The action network has, since 2013, developed an 'Efficiency Matrix' (EM) tool to enable quantification and decision-making to increase production system efficiency and sustainability.

The network's members represent a wide range of global regions and institutions, from different disciplines and backgrounds. The Matrix remains an open exercise, with continuous improvement at its core, through shared learning and application.

The Efficiency Matrix

The Efficiency Matrix (EM) is a framework to quantify the impact of specific interventions or production system changes on natural resource use efficiency. It aims to describe the impact of production system changes, and so act as a decision-making advisory tool. Because livestock production systems are very diverse, phase one of the EM's development aims to provide a broad umbrella of assessment indicators that can be applied to different environments, geographies and scales of farming, with a broad enough reach to fit with existing assessments. This evaluation should reflect efficiency such as productive performance, but also respect wider facets of sustainability including environmental, animal welfare and social impact. The main long term objective of the EM is to provide an agreed, comprehensive and applied framework to assess NRUE in livestock production systems.

We hope people will use these tools in the field, describe their results and feed these back into the action network to shape future application of the tool to enable its wider use to increase sustainability.

The EM identifies four core efficiency areas. The main purpose of these areas is to provide production systems with "working boxes", or categories, each of which contains a set of indicators for measuring efficiency. The areas are shown as 'vertical assessment' areas in the model, as follows:

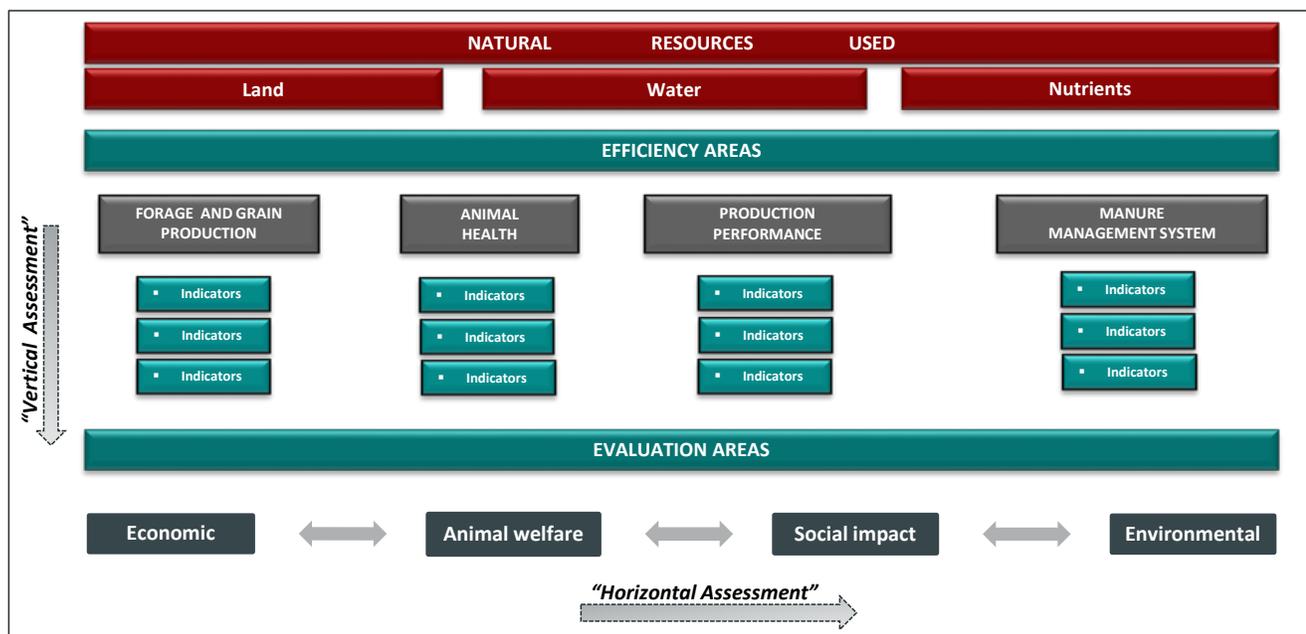
- Forage and grain production and feeds and nutrition
- Animal health
- Production performance
- Manure management system

In order to assess the wider consequences of production system changes, the EM also has aims to develop four cross-cutting “horizontal assessment”, evaluation areas:

1. Economics
2. Animal welfare
3. Social impact
4. Environmental impact

The “horizontal assessment” aims to make the wider consequences of change transparent. Each element of the horizontal assessment is designed to be descriptive and gives a broad overview. These aspects of the EM will be further developed in phase two of the efficiency matrix. The main components of the EM are shown in figure 1.

Figure 1. Elements of the Efficiency Matrix



How Can We Use the Efficiency Matrix to Inform Practice Change?

The EM is a generic approach with no specification of animal species or production system. It can evaluate future interventions in production systems which present good potential for greater efficiency. Once interventions are identified, there is a need (i) to define a baseline reference scenario, or starting point for intervention; (ii) to identify practical alternatives for improving efficiency with local stakeholders; and (iii) to select and model / test the most promising options for practice change.

To test the Efficiency Matrix methodology in the field, within the context of the Global Agenda’s activities, projects, or ‘pilots’ are needed to test and quantify the benefits of practice change, and to demonstrate real examples of how to narrow the efficiency gap. Four types of pilot projects are sought to engage with the action network:

- Existing initiatives with which the action network can collaborate through the implementation of a NRUE evaluation using the Efficiency Matrix provide practical testing and input for the further development of the EM 's use on the ground. The existing initiatives will conversely derive direct benefit from the application of the NRUE assessment framework developed through the action network;
- New pilot projects specifically designed and funded through the action network to assess production systems with high potential for 'win win' efficiency, social, animal welfare, economic and /or environmental gains;
- Collaborations on other methodologies and metrics with projects and initiatives that also work on NRUE (such as water efficiency methodologies);
- Targeted inputs and support to the development of new start-up projects.

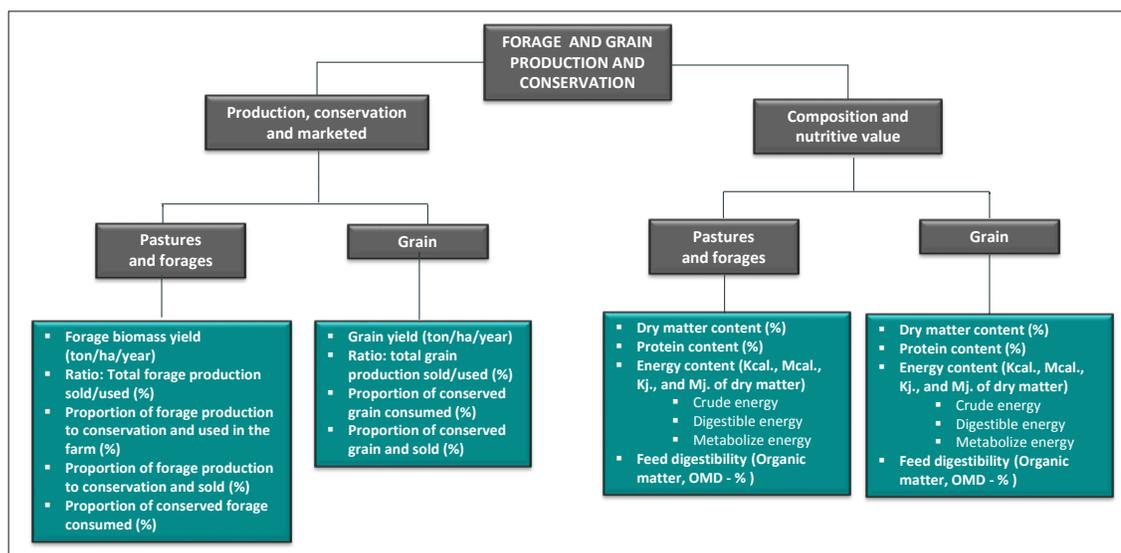
Inside the Efficiency Matrix: 'Working Boxes' and Metrics

Action network members have defined general indicators for each working box, detailed below.

Production of Feed and Animal Feeding

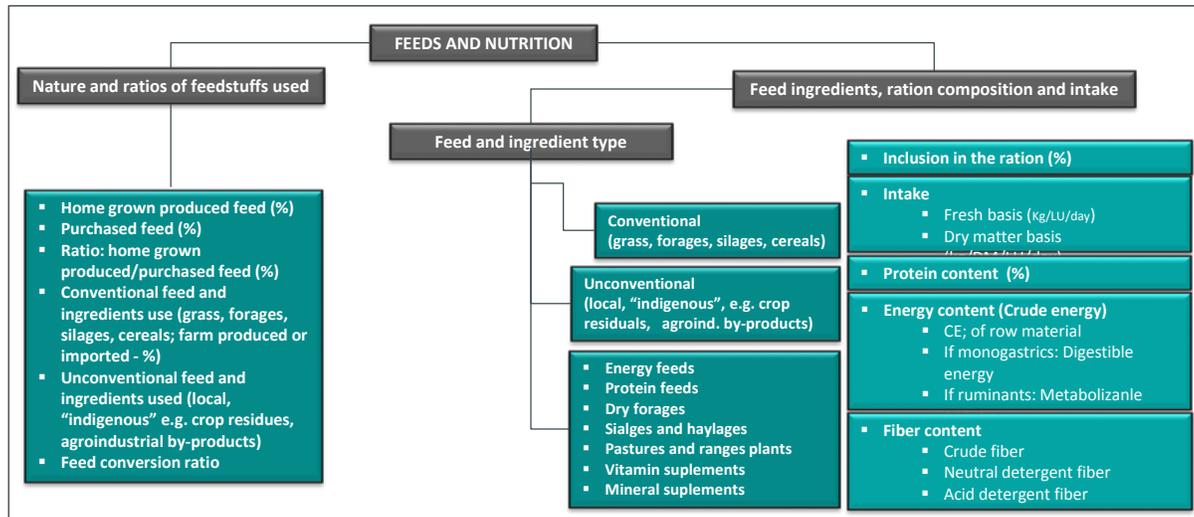
Two main elements are quantified: (a) forage and grain production, including conservation and sales (Figure 2) and (b) feed composition and nutritive value (Figure 3). Production includes the proportion of farm area used for forage and grain production and annual yield in forage biomass and grain produced on farm. It considers the quantity of forage destined to direct consumption by animals in the farm (fresh), to conservation as hay or silage and/or for selling (irrespective of the form –fresh or conserved).

Figure 2. Indicators for Forage and Grain Production and Conservation



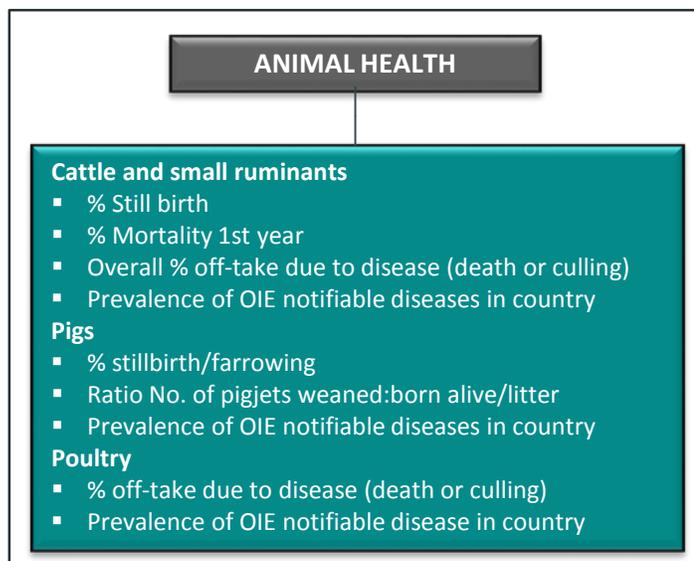
Regarding feed and nutrition, it is important to define the nature of feedstuffs used and the proportion of each of these elements in the ration composition. On an annual (or seasonal) basis, and from the totality of feeds offered to the flock on the farm, it is necessary to define how much has been produced on the same farm, how much has been purchased, and how much of the feeds/ingredients used could be qualified as conventional or unconventional (see Figure 3).

Figure 3. Indicators for Feeds and Nutrition



Then, it would be possible to calculate percentages and ratios of using home grown vs. purchased and conventional vs. unconventional.

Finally, when analyzing the type of each ingredient formulated, offered and consumed, there is a need to measure nutritive value of these ingredients (protein, energy and fiber content).



Animal Health

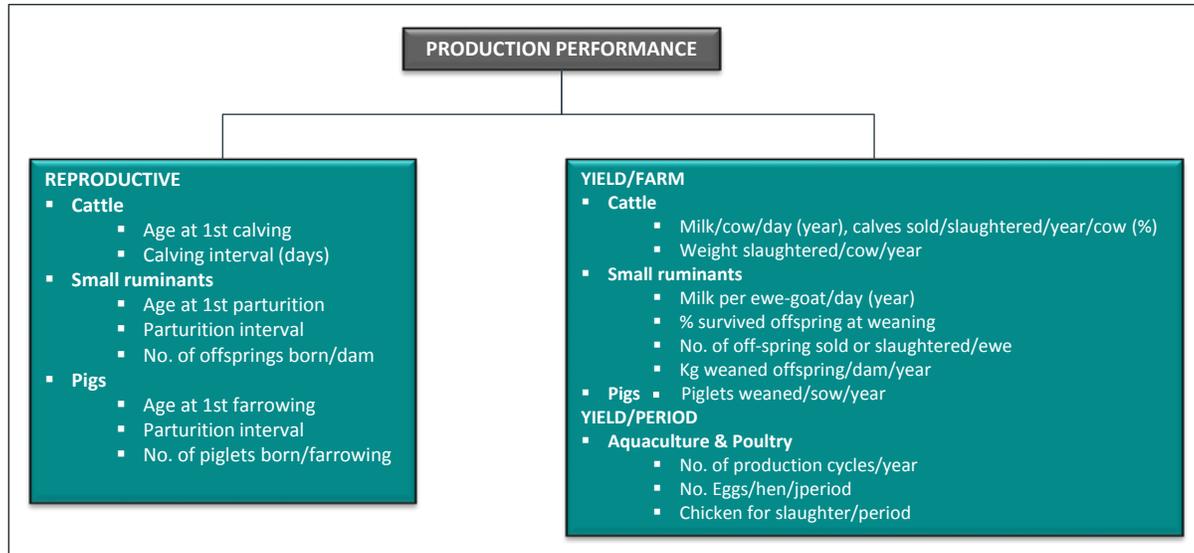
Animal health assessment measures the capacity of the production system to prevent, control and manage diseases which can affect animal performance and therefore animal production. Indicators include mortality ratios at different ages and stages of the production process, as well as off-take ratios due to disease. Prevalence of notifiable diseases should be measured (see World Organization for Animal Health – www.OIE.int).

Figure 4. Indicators for Animal Health

Production Performance

The main production performance indicators used are reproductive performance and animal yields. Reproductive performance includes numbers of animals born and herd fertility: calving intervals and age at 1st calving. Regarding animal yields, there is a need to differentiate between yields per farm and yields per period (mainly applied to aquaculture and poultry).

Figure 5. Indicators for Production Performance

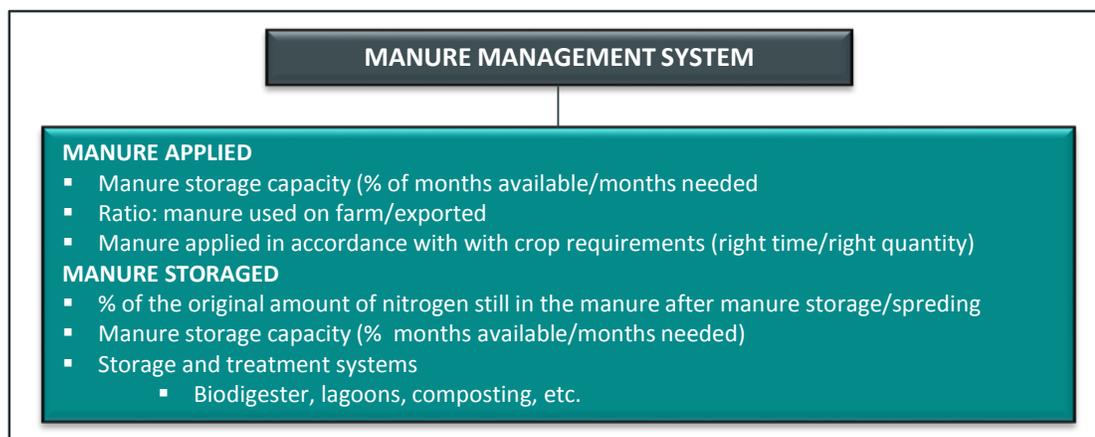


Manure Management System (MMS)

Important quantities of valuable nutrients coming from feed are still present in the animal waste. This section assesses the capacity of the system to recycle nutrients. This in turn depends on the correlation between manure applied and stored, varying according to the livestock system and its boundaries (export/import nutrients).

Assessment of manure storage is also important for (i) leakage of nutrients to water; (ii) emissions of methane and ammonia to the air and (iii) storage so manure can be applied at the appropriate time. Instead of manure storage, some farmers practise some form of manure processing, ranging from simple separation methods to anaerobic digestion, or reverse osmosis.

Figure 6. Indicators for Manure Management System



Wider Sustainability Evaluation: Economic, Animal Welfare, Social and Environmental Impact (“Horizontal Assessment”)

The core focus of the action network is to improve natural resource efficiency but this must be done in the context of wider sustainability so as to achieve viable practice change.

Economic impact: In a market economy, practice change is usually achieved if the situation after the change is more profitable than the status quo, irrespective of whether the increase in profitability is coming from market or from subsidy income. It therefore requires an economic evaluation of all measures for the improvement of the natural resource efficiency.

Social and animal welfare impact: Sustainability is a more integrated concept however, and to obtain a realistic and comprehensive assessment of the impact of practice change on sustainable livestock outcomes, animal welfare and social impacts need to be included. Many factors such as natural resource use, animal performance, animal health, economics, social and animal welfare are interlinked and improvement of one area might positively or negatively affect one or more of the other fields.

This can allow the identification and prioritization of potential ‘win win’ scenarios, where a practice change solution achieves benefits across a range of sustainability criteria. Alternatively, it also allows risks to be identified objectively. The result would be a non-sustainable situation in the sense of the Agenda's objectives. Some illustrations include:

- Better resource use efficiency could be less profitable due to lower animal performance / productivity and a lack of compensation from market (price) or subsidy income.
- Highest levels of animal performance measured by one aspect (in terms of daily weight gain, final weights, feed conversion etc.) can coexist with animal welfare issues such as health related reductions in fertility, increases in disease or reductions in longevity.
- Systems of production that manage animal health and welfare as an integrated aspect of production are highly socially acceptable in developed markets and may increase market access and profitability.
- Robust locally adapted breeds are often more resilient to environmental challenges and thus may be less likely to lose condition and consequent productivity.

Economic Evaluation

Indicators should measure the economic impacts of resource use efficiency. The following principles underpin economic evaluation:

- Indicators can be selected to measure economic performance on a per animal or per kg output basis but also on enterprise level (cow-calf, beef finishing and sheep) as well as on whole farm level. The enterprise level can reflect changes in the herd size with an impact on the total income of the enterprise which are not necessarily visible on a per animal or per kg output basis.

□ The whole-farm level can reflect interactions between enterprises as well as incomes and subsidies which are not linked to one enterprise only but affect the overall profitability of the farm. Performance and productivity changes affecting weights or numbers of animals will affect all costs and returns which are expressed on a per kg or per ha basis.

Figure 7. Indicators for Economic Evaluation

Economic evaluation				
Economic indicators	Indicators			
	level	Enterprise level		Whole-farm level
	enterprise level	cow-calf, beef finishing, sheep		all enterprises
	reference units	per animal, kg live weight or carcass weight per ha	per enterprise per ha	per farm per ha
Returns / Receipts (quantity * price)				
- Total returns		x	x	x
- Market returns		x	x	x
- Government payments (subsidies)		x	x	x
Costs (where possible quantity * price)				
- Total costs, breakdown into up to 50 items		x	x	x
- Feed costs (incl. purchase feed, fertilizer costs)		x	x	x
- Other costs		x	x	x
- Social prices and costs (where possible)		x	x	x
Profitability				
- Margin over feed costs		x	x	
- Margin over cash costs		x	x	x
- Medium-term profitability 1)		x	x	x
- Long-term profitability 2)		x	x	x
1) total returns less cash costs less depreciation				
2) medium-term profitability less opportunity costs				

Animal Welfare Evaluation

Animal welfare indicators need to reflect the aspects of the farming system which directly influence the welfare of the animal. The welfare of the animal thus can be measured both in terms of the potential of the system to deliver good welfare through resources provided (such as feed quality, veterinary care, access to exercise or resources to enable important behaviours and reduce stress); and the measurement of the welfare outcomes of the system for the animals themselves (whether the potential of the farm is achieved at individual and herd level).

As agreed by consensus internationally amongst scientists, NGOs, industry, and intergovernmental agencies such as the World Organisation for Animal Health (OIE), animal welfare includes both the animal’s health and behavioural / psychological welfare. Animal welfare science has developed as a discipline to evidence both physiological and psychological aspects of animal wellbeing.

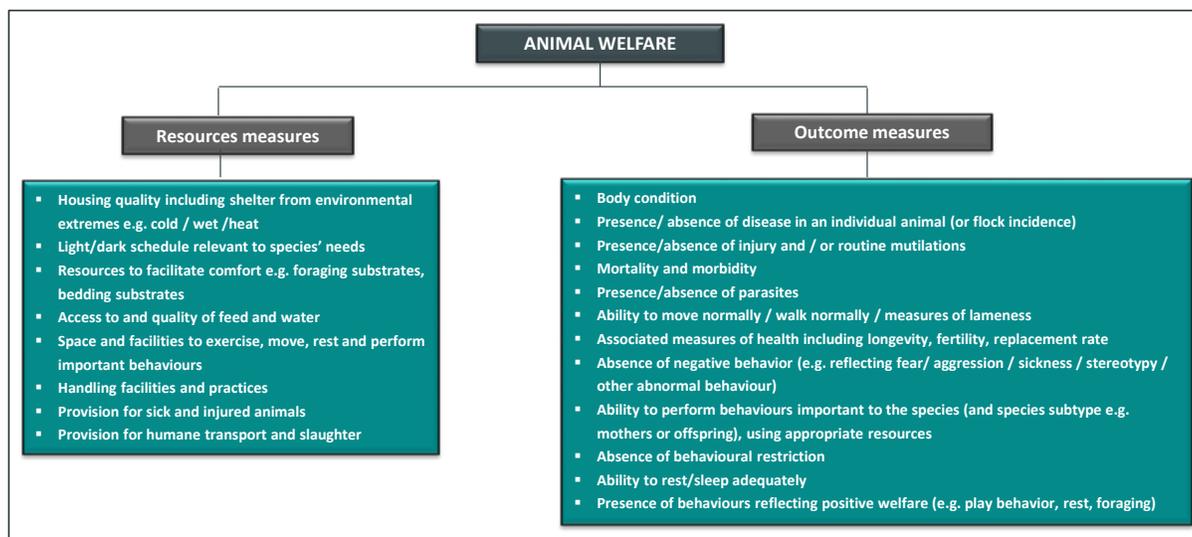
Aspects of welfare can be viewed from the perspective of both an absence of negative outcomes as outlined by the ‘Five Freedoms’ approach to welfare (such as pain, thirst or hunger, fear or distress, or restriction of behaviour); however modern approaches to animal welfare also focus on

what the animal needs to have good welfare: including good feeding, good health, good housing, appropriate behaviour.

To enable practice change and continuous improvement, measures of animal welfare should be relevant to the farmer wherever possible, though their core purpose is to describe the state of the animal. It should be noted that the assessment indicators below focus on terrestrial animals rather than fish.

These core themes of welfare indicators can be used to assess welfare across all species. Consistent broad approaches relevant to many species and farming systems are helpful when considering assessment between farming types and across diverse farming systems. The core themes are described in Figure 8.

Figure 8. Animal Welfare Measures



Indicators and metrics of welfare vary between species - and species specific requirements to achieve good welfare in real on farm situations are likely to vary significantly, as well as for a particular species at different life stages. Extensive scientific evidence is available to help define resource and outcome measures for specific species within the farm context. These include the OIE guidelines on animal welfare, scientific evaluations by the Welfare Quality project, European Food Safety Authority reports and International Society for Applied Ethology journals. A repository of scientific resources and examples of use of welfare metrics could be made available in future through the Livestock Dialogue website.

Environmental Evaluation

The environmental assessment of NRUE is a key element of the EM. To prevent multiple development of metrics, the EM utilises metrics defined by the Livestock Environmental Assessment and Performance partnership (LEAP). The LEAP partnership is a multistakeholder initiative facilitated by the FAO to deliver cohesive approaches to assessment of environmental impact (see <http://www.fao.org/partnerships/leap/en/>). Its first phase has developed methodologies

for greenhouse gas emissions (GHG) across a range of species; LEAP phase two will build agreed methods for assessing water and nutrient impacts.

Social Impact Evaluation

Phase two of development of the Efficiency Matrix will include development of quantitative measures of social impact. The action network is currently seeking greater involvement from stakeholders with expertise to join its development of this assessment area.

Next Steps in Development of the Efficiency Matrix

The Efficiency Matrix's strengths arise from the consensus approach to its development, due to the diversity of stakeholders engaged in its creation; and the breadth of its ability to incorporate efficiency measures. However, it is a prototype in its first stage, and now needs to be further developed, applied and refined. In phase two, pilot projects will apply the metrics in the field, supplying valuable feedback on practical application, allowing streamlining of metrics according to systems type and scale. Further development and application of economic and animal welfare assessments will allow wider implications to become transparent. Integration of LEAP environmental measures will be important to ensure joined up assessment on the ground. Finally, development of the social component of the Efficiency Matrix will enable the tool to fully describe implications of improved resource use efficiency across all elements of sustainability, in line with delivery of the sustainable development goals (SDGs). It will also be beneficial to identify how the EM can be utilized in non-farm situations, such as for pastoralist systems. It is hoped that this framework provides a foundation that can catalyse decision-making and action toward a more sustainable livestock sector, in support of the SDGs.

Key Characteristics Required for Success

Parameters of efficiency are evidence led and agreed by consensus.

Consistency with existing assessment models enables comparison with evidence from other assessment processes.

Wider sustainability assessment allows efficiency changes to be evaluated alongside the consequences for broader sustainability parameters.

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